

CLAIMS

What is claimed:

- 5 1. An electro-pneumatic apparatus, comprising:
 - (a) a first valve adapted to receive an electrical signal for opening the first valve, and wherein the first valve is further adapted to deliver a first pneumatic control signal when open;
 - (b) a second valve adapted to receive an electrical signal for opening the second valve, and wherein the second valve is further adapted to deliver a second pneumatic control signal when open; and
 - (c) a third valve in communication with the first and second valves, and wherein the third valve is adapted to receive pneumatic control signals, and wherein the third valve opens upon receiving the first pneumatic control signal and closes upon receiving the second pneumatic control signal.
- 10 2. The apparatus of claim 1, further comprising an electrical switch unit in electrical communication with the first and second valves for sending the electronic signals.
- 15 3. The apparatus of claim 1, further comprising:
 - (a) a source of pressurized control air in communication with the first and second valves; and
 - (b) a source of pressurized supply air in communication with the third valve, and wherein the pressurized supply air passes through the third valve when the valve is open.
- 20 4. The apparatus of claim 3, further comprising a terminal device in communication with the third valve, and wherein the terminal device is adapted to receive pressurized supply air when the third valve is open and exhaust pressurized supply air when the third valve is closed.
- 25 5. The apparatus of claim 4, wherein the terminal device is a spring brake or a pneumatic lift.
- 30 6. The apparatus of claim 1, wherein the first and second valves are solenoid valves.

7. An electro-pneumatic valve system, comprising:

- (a) a first valve adapted to receive an electrical signal for opening the first valve, and wherein the first valve is further adapted to deliver a first pneumatic control signal when open;
- 5 (b) a second valve adapted to receive an electrical signal for opening the second valve, and wherein the second valve is further adapted to deliver a second pneumatic control signal when open;
- 10 (c) a third valve in communication with the first and second valves, and wherein the third valve is adapted to receive pneumatic control signals, and wherein the third valve opens upon receiving the first pneumatic control signal and closes upon receiving the second pneumatic control signal;
- 15 (d) an electrical switch unit in electrical communication with the first and second valves for sending the electrical signals;
- (e) a source of pressurized control air in communication with the first and second valves;
- 20 (f) a source of pressurized supply air in communication with the third valve, and wherein the pressurized supply air passes through the third valve when the valve is open; and
- (g) a terminal device in communication with the third valve, and wherein the terminal device is adapted to receive pressurized supply air when the third valve is open and exhaust pressurized supply air when the third valve is closed.

8. The system of claim 7, further comprising an electrical control unit in electrical communication with the switch unit and the valves for controlling the operation of the system.

25 9. The system of claim 7, wherein the first and second valves are solenoid valves, piezoelectric valves, or micro machine valves.

30 10. The system of claim 7, wherein the terminal device is a spring brake or pneumatic lift device.

11. An electro-pneumatic system for operating a spring brake, comprising:
- (a) a means for generating an electrical signal for opening a first valve, and wherein the first valve is adapted to deliver a first pneumatic control signal when open;
 - 5 (b) a means for generating an electrical signal for opening a second valve, and wherein the second valve is adapted to deliver a second pneumatic control signal when open;
 - (c) a means for receiving the pneumatic control signals at a third valve, and wherein the third valve opens upon receiving the first pneumatic control signal and closes upon receiving the second pneumatic control signal;
 - 10 (d) a means for delivering pressurized supply air through the third valve when open and into the spring brake for releasing the spring brake; and
 - (e) a means for exhausting the pressurized supply air from the spring brake when the third valve is closed for applying the spring brake.
- 15 12. An electro-pneumatic system for controlling the parking and emergency brakes of a vehicle, wherein the vehicle includes a truck portion, comprising:
- (a) a driver interface, wherein the driver interface further comprises an electrical switch unit for sending electrical signals;
 - (b) a brake control subsystem in electrical communication with the driver interface, 20 and wherein the brake control subsystem further comprises:
 - (i) a first valve adapted to receive an electrical signal for opening the first valve, and wherein the first valve is further adapted to deliver a first pneumatic control signal when open;
 - (ii) a second valve adapted to receive an electrical signal for opening the second valve, and wherein the second valve is further adapted to deliver a second pneumatic control signal when open;
 - (iii) a third valve in communication with the first and second valves, and wherein the third valve is adapted to receive pneumatic control signals, and wherein the third valve opens upon receiving the first pneumatic signal and closes upon receiving the second pneumatic signal; and

- (c) a source of pressurized control air in communication with the first and second valves;
- (d) a source of pressurized supply air in communication with the third valve, and wherein the pressurized supply air passes through the third valve when the valve is open; and
- (e) at least one spring brake in communication with the third valve for receiving and exhausting the pressurized supply air, and wherein the spring brake is released upon receiving the supply air and applied upon exhausting the supply air.
- 10 13. The system of claim 12, further comprising a primary electrical power supply in electrical communication with the driver interface system.
14. The system of claim 12, further comprising a secondary electrical power supply in electrical communication with the driver interface system.
- 15 15. An electro-pneumatic system for controlling the parking and emergency brakes of a vehicle, wherein the vehicle includes a tractor portion and a trailer portion, comprising:
- (a) a driver interface subsystem, wherein the driver interface subsystem further comprises:
- 20 (i) a first electrical switch for operating the pneumatic brakes on the tractor portion; and
- (ii) a second electrical switch in communication with the first electrical switch for operating the brakes on the trailer portion; and
- (b) a brake control subsystem in electrical communication with the driver interface subsystem, wherein the driver interface subsystem further comprises:
- 25 (i) a remote module, the remote module further comprising a first electro-pneumatic valve unit in communication with the first electrical switch for controlling the parking and emergency brakes of the tractor portion and a second electro-pneumatic valve unit in communication with the second electrical switch for operating the parking and emergency brakes of the trailer portion; and
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(ii) a tractor protection module in pneumatic communication with the remote module, the tractor protection module further comprising a means for controlling the parking and emergency brakes on the trailer and a means for preventing the delivery of pneumatic pressure to the trailer.

- 5 16. The system of claim 15, further comprising at least one source of pressurized control air and pressurized supply air in communication with the electro-pneumatic valve assemblies.
- 10 17. The system of claim 15, further comprising a primary electrical power supply in electrical communication with the driver interface system.
- 15 18. The system of claim 15, further comprising a secondary electrical power supply in electrical communication with the driver interface system.
- 20 19. The system of claim 15, further comprising at least one spring brake in pneumatic communication with the remote module.
- 25 20. The system of claim 15, further comprising a foot brake valve and a trailer control valve in pneumatic communication with the tractor protection module.
- 30 21. The system of claim 15, further comprising an electronic control unit in communication with the driver interface and the brake control subsystem for controlling the operation of the system.
- 25 22. The system of claim 15, wherein the driver interface is mounted in the dashboard of the vehicle, and wherein the remote module and the tractor protection module further comprise components that are mounted on at least one of the interior of the vehicle and the exterior of the vehicle.
- 30 23. The system of claim 15, wherein actuating the first switch to apply the parking brakes automatically actuates the park function of the second switch unit.

24. The system of claim 15, wherein the electrical switches are three-position, momentary on-off-on switches.
25. The system of claim 15, wherein the means for preventing the delivery of pneumatic pressure to the trailer further comprises a service line shut-off valve.
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26. The system of claim 15, wherein each of the electro-pneumatic valve assemblies further comprises:
- 10 (a) a first valve adapted to receive an electrical signal for opening the first valve, and wherein the first valve is further adapted to deliver a first pneumatic control signal when open;
- 15 (b) a second valve adapted to receive an electrical signal for opening the second valve, and wherein the second valve is further adapted to deliver a second pneumatic control signal when open; and
- 20 (c) a third valve in communication with the first and second valves, and wherein the third valve is adapted to receive pneumatic control signals, and wherein the third valve opens upon receiving the first pneumatic control signal and closes upon receiving the second pneumatic control signal.
27. The system of claim 1, wherein the first and second valves are solenoid valves.
28. A method for controlling a vehicle's pneumatic brakes, comprising the steps of:
- 10 (a) supplying pressurized control air to a first valve, wherein the first valve is in electric communication with a release switch for opening and closing the first valve;
- 15 (b) supplying pressurized control air to a second valve, wherein the second valve is in electric communication with an apply switch for opening and closing the second valve;
- 20 (c) supplying pressurized supply air to a third valve, wherein the third valve is in pneumatic communication with the first and second valves, and wherein the third valve is opened in response to control air received from the first valve, and wherein the third valve is closed in response to control air received from the second valve; and
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(d) controlling the delivery of pressurized supply air to the pneumatic brakes, wherein the brakes are in pneumatic communication with the third valve, and wherein pressurized supply air received from the third valve releases the brakes, and wherein pressurized air exhausted from the third valve applies the brakes.

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29. The method of claim 28, wherein the first and second valves are solenoid valves or pilot operated pneumatic valves.
30. The method of claim 28, wherein the pneumatic brakes are spring brakes.